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A new species of *Xenomyia* Malloch, 1921 (Diptera: Muscidae) from South Africa, a probable natural antagonist of blackflies (Diptera: Simuliidae)

by

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ABSTRACT

A new species of the genus *Xenomyia* Malloch, *Xenomyia osculata*, is described from the Orange River, Northern Cape, South Africa. It was collected in association with the blackfly *Simulium chutteri* Lewis, 1965, upon which it probably preys in the adult and larval stages. This description includes the first published illustrations of the aedeagus and ovipositor of a species of *Xenomyia*.

INTRODUCTION

The genus *Xenomyia* Malloch is a small genus of predaceous flies, confined to the Afrotropical Region. The species *Xenomyia oxycera* Emden, 1951 is well known as an antagonist of the aquatic and adult stages of blackflies in West Africa, including members of the *Simulium damnosum* Theobald complex (Crosskey & Davies 1962; Gouteux 1977; Elsen 1977), but the species described here is the first *Xenomyia* known to prey on blackflies in Southern Africa.

This species was collected by Dr R. W. Palmer from the middle Orange River and was submitted to us for identification by Dr D. A. Barraclough of the Natal Museum, Pietermaritzburg. It was recorded as *Xenomyia* sp. by Palmer (1997: x, 77), who listed it as a blackfly predator. It is described here in order to provide a name for what appears to be an important member of the lotic community of the Orange River, and forms a contribution to our ongoing study of the dipteran predators of blackflies (Werner & Pont, 2003).

Blackfly plagues along the middle Orange River have been documented by Palmer (1997), and between 1990 and 1995 the larvicides *Bacillus thuringiensis* var. *israelensis* and temephos were used for the control of *Simulium chutteri* Lewis, 1965, the major cattle-biting species (Palmer *et al.*, 1996). Larvicides were applied by helicopter to rapids between Hopetown and Onseepkans, a river distance of 807 km, and the success of this control programme was assessed independently by local farmers. In searching for longer-term and environmentally-friendly methods of blackfly population management, the role of predators such as the species described here needs to be investigated in more detail (Palmer, 1997).

MATERIAL AND METHODS

The material studied is located in the following museums (codens in parentheses): The Natural History Museum, London, U.K. (BMNH). Natal Museum, Pietermaritzburg, South Africa (NMSA). Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (ZMHU).

Descriptive terminology is based mainly on McAlpine (1981).

DESCRIPTION

Xenomyia osculata sp. n.

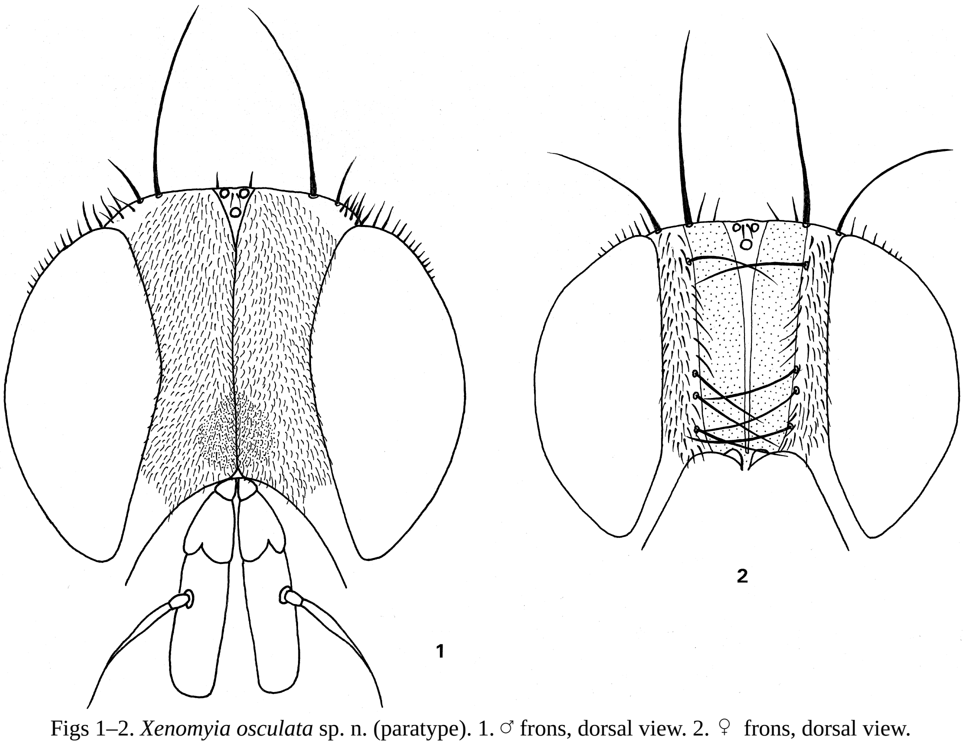
(Figs 1–11)

Holotype ♂: SOUTH AFRICA: *Northern Cape*: Gifkloof, 15 km E of Upington, 28.26.05 S, 21.23.45 E, 11.xi.1996, R.W.Palmer. In NMSA.
Paratypes: Same locality data (5♂ 2♀ NMSA, 2♂ 1♀ BMNH, 2♂ ZMHU).

Etymology: The epithet *osculata* is formed from the Latin verb 'osculari', 'to kiss', and refers to the kiss of death administered by *Xenomyia* to its prey.

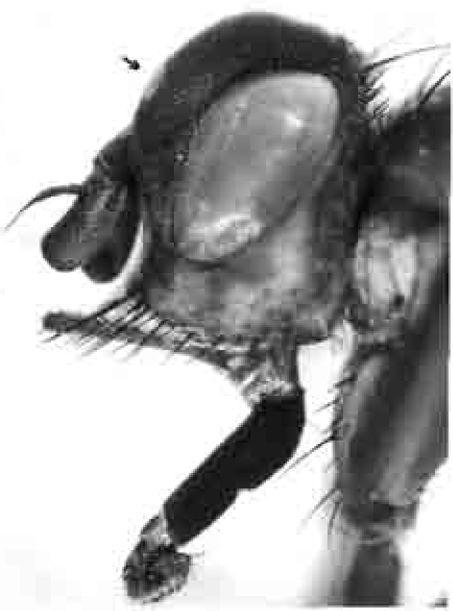
Male:

Head: Of extraordinary shape (Figs 1, 3), the eye small, the frons arched; the fronto-orbital plates enlarged and touching for almost their entire length, completely devoid of setae but mostly covered with dense small setulae. Ground-colour black. Frons broad, the margins concave (Fig. 1), at mid-length 0.33 of greatest head-width. Eye with a few short sparse hairs, without areas of enlarged facets. Ocellar setae absent. Inner verticals strong, convergent; outer verticals short, one quarter length of inner verticals, hardly twice as long as the adjacent post-ocular setulae. Fronto-orbital plate, parafacial and



Figs 1–2. *Xenomyia osculata* sp. n. (paratype). 1. ♂ frons, dorsal view. 2. ♀ frons, dorsal view.

vibrissal area brown pruinose, from some angles the fronto-orbital plate more golden-brown and with traces of a weak silvery spot just before lunula (stippled in Fig. 1, arrow in Fig. 3); upper third of occiput grey pruinose, lower occiput, gena and face white. Fronto-orbital plates enlarged and arched, with dense short setulae for their entire length and for most of their width; without trace of frontal or orbital setae; frontal vitta completely suppressed. Parafacial at middle 0.4 width of antennal flagellomere, bare. Antennomeres and arista black. Antenna almost reaching mouth-margin; in lateral view, flagellomere twice as long as broad. Arista very short, only slightly longer than length of flagellomere; short-pubescent, the longest individual hairs as long as basal width of



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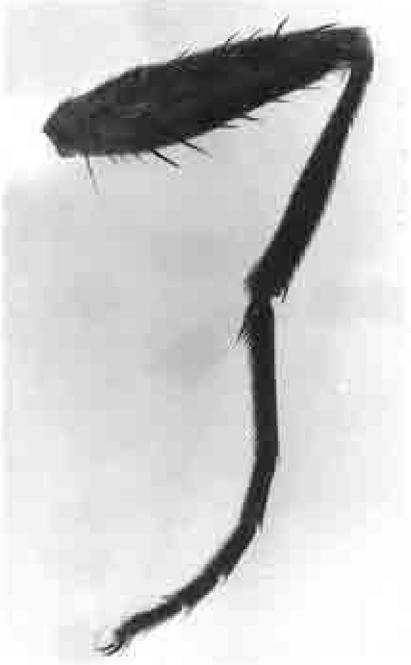

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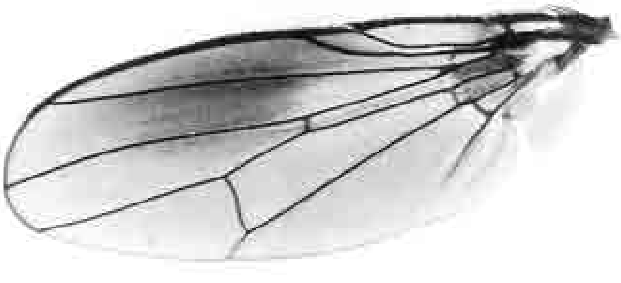

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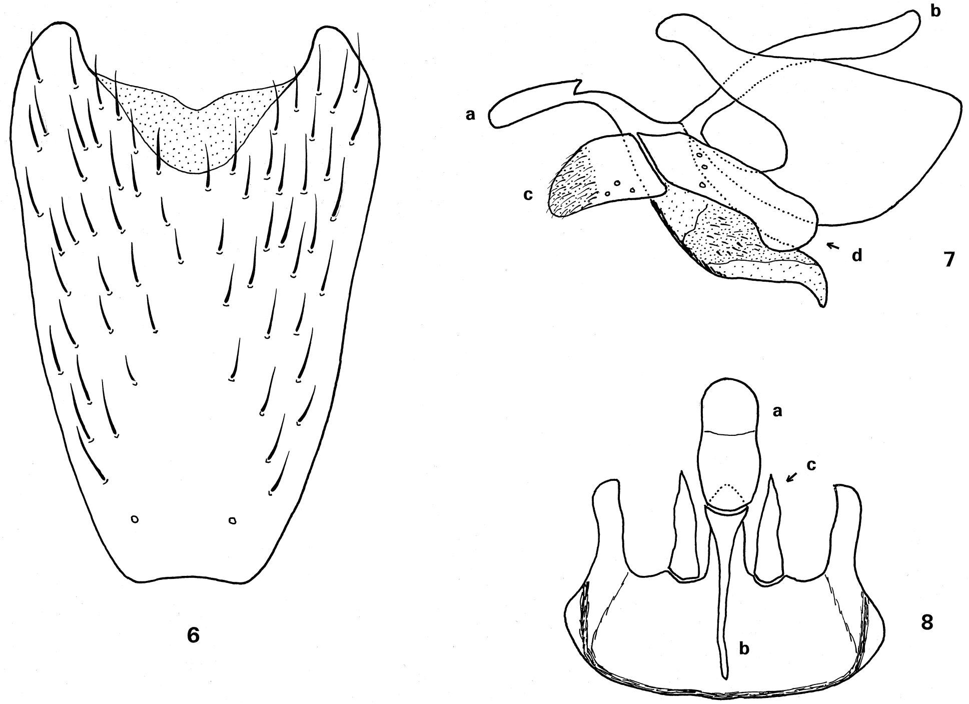
Figs 3–5. *Xenomyia osculata* sp. n. ♂ (paratype). 3. Head, lateral view. 4. Fore femur, posterior view. 5. Wing.

arista. Vibrissae strong, with a strong pair of subvibrissals, the vibrissal setulae ascending to mid-length of facial ridge. Gena deep, 0.3 of greatest eye-depth; genal row of setae sparse and weak. Proboscis elongate (Fig. 3), dark brown, prementum undusted, glossy; labellum with 3 pairs of stout teeth. Palpi rather swollen in apical third, yellow, becoming brown on the swollen part.

Thorax: Ground-colour black. Scutum dark brown, subshining, with a median presutural patch of white dust between the dorsocentrals that extends backwards to level of first postsutural dorsocentral or just beyond and which is medially completely or partly divided by the dark ground-colour; usually with pair of indistinct small grey patches between the dorsocentrals in front of scutellum; the area between presutural intra-alar, presutural supra-alar and postpronotal setae, and the entire notopleuron, white dusted; pleura white to light grey dusted, tinged with brownish on upper and posterior anepisternum and anterior katepisternum. Scutellum dark brown, subshining, the margins grey dusted. Scutal ground-setulae short and sparse. Acrostichal setulae in 2–3 rows before suture, 3–4 irregular rows behind suture, the prescutellar setae hardly distinct. Dorsocentrals 2+3. Intra-alars 1+2. Supra-alars 1+1, prealar absent. 1 postpronotal (the outer), the lobe covered with short dense setulae. Prosternum bare. Proepisternal depression bare; 1 seta and 1–2 adjacent setulae. 1 proepimeral, with a forwardly-directed setula below. Notopleuron with 2 setae, the posterior one half as long as anteror one, without setulae. Anepisternum without a short seta in upper anterior corner. Katepisternals 1+2, only the upper posterior one strong, the lower posterior one much closer to upper posterior than to anterior seta. Anepimeron, katepimeron, meron, katatergite and anatergite bare. Posterior spiracle without setae on margins. Scutellum with a pair of sub-basal lateral and apical setae; disc sparsely setulose, lateral margins and ventral surface bare.

Legs: Legs apparently wholly dark brown, but because the specimens have been retrieved from alcohol some of them have the femora and tibiae partly yellow, but this appears to be an artefact. Fore coxa with several spine-like setae and setulae on anterodorsal surface. Fore femur without anteroventral setae; with a posterodorsal row and several posterior setae around middle; a row of 5–7 short spine-like posteroventral setae (Fig. 4). Fore tibia without submedian setae; dorsal and posteroventral apical setae very short, less than tibial diameter. Mid femur without ventral setae, with 1–2 short anterior setae around middle; 0 anterior and 1 posterior preapical seta. Mid tibia with 1 submedian posterior seta, otherwise without setae. Hind femur with an anterodorsal row and 1 posterodorsal preapical seta; without ventral setae. Hind tibia with only 1 anterodorsal and 1 posterodorsal seta at middle, both at about the same level; 1 short dorsal apical, without anterodorsal or posteroventral apicals. All tarsi long, slender, without modifications, the claws not elongated.

Wing (Fig. 5): Wing membrane completely covered with microtrichiae, but in apical half of wing with an area of longer denser microtrichiae between vein R_{4+5} and costa (Fig. 5), resembling a wing-cloud. Basicosta and tegula black. Venation as in Fig. 5, veins bare except for costa. Calypters creamy-white, lower one of the '*Phaonia*-type' and projecting slightly beyond upper one. Haltere with the stalk creamy and the knob white.



Figs 6–8. *Xenomyia osculata* sp. n. ♂ (paratype). 6. Sternite 5, dorsal view. 7. Hypandrium and aedeagus, lateral view. 8. Hypandrium and some aedeagal processes, dorsal view. a - epiphallus; b - phallapodeme; c - postgonite (paramere); d - praegonite (gonopod).

Abdomen: Ground-colour black. Tergites subshining brownish-black, with narrow areas of grey dust appearing like inverted triangles along the sides of tergites 1+2, 3, 4 and 5. Tergites with few setae, tergites 3, 4 and 5 each with 2–3 pairs of fine lateral marginals. Sternite 1 bare, sternites 2–4 grey dusted and with a few sparse setae; sternite 5 as in Fig. 6.

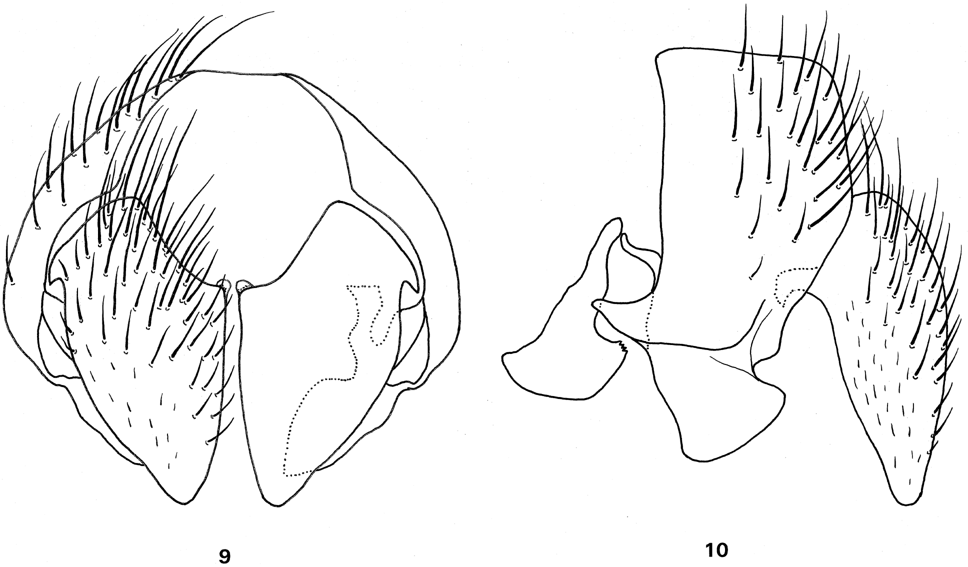
Genitalia (Figs 7–10): Cercal plate divided. Surstyli short, stout. Aedeagus with the epiphallus well-developed; phallapodeme narrow; praegonite (gonopod) long, simple; postgonite (paramere) with a micro-haired, membraneous area in apical part; distiphallus simple, juxta without spinules.

Measurements: Wing length 3.5–4.0 mm. Body length 4.5–5.0 mm.

Female:

Differs from the male as follows:

Head: Shape and structure very different from the male. Frons broad (Fig. 2), at mid-length 0.42 of greatest head-width, more or less parallel-sided. Eyes bare. Ocellars absent. Outer verticals stronger, half length of inner verticals. Fronto-orbital plates dull grey pruinose, conspicuously tinged with brown in upper half, white below against eye-margin; parafacial, face, gena, lower half of occiput white, upper half of occiput grey, vibrissal area narrowly brownish. Fronto-orbital plates broad, at mid-length 0.6 width of frontal vitta and 0.27 width of frons. 3–4 pairs of frontal setae, directed inwards



Figs 9–10. *Xenomyia osculata* sp. n. ♂ (paratype). 9. Hypopygium, dorsal view. 10. Hypopygium, lateral view.

and forwards; 1 pair of orbitals, also directed inwards and forwards; the plates otherwise covered with short fine dark setulae, but these longer and sparser than in male. Frontal vitta bare; frontal triangle narrow and reaching to lunula. Parafacial slightly broader. Antennal flagellomere narrower but still twice as long as broad. Arista longer and narrower, 1.4 times length of flagellomere; the longest hairs thus slightly longer than its basal width.

Thorax: Pleura mostly white dusted, the darkening only weakly indicated.

Legs: Fore femur on posteroventral surface with 3–4 long fine setae, without spine-like setae.

Wing: Faintly smoky, but without the area of longer denser microtrichiae.

Abdomen: Setae weaker and less differentiated.

Ovipositor (Fig. 11): Twice as long as length of tergite 5. Tergites 6, 7 and 8 well-developed, broadly divided dorsally. Cerci not separated from epiproct, these two setulose and without spines. Sternite 6 elongate-rectangular; sternite 7 represented by a very small plate; sternite 8 absent, or at least not detected. The membrane between sternites 7 and 8 microspinulose. Hypoproct elongate-semicircular, setulose and without spines. 3 spherical spermathecae.

Measurements: Wing length 4.5–5.0 mm. Body length 5.5–6.0 mm.

Distribution: Known only from the middle Orange River, Northern Cape, South Africa.

Relationships: There are 15 described species of *Xenomyia* (Pont 1980), of which six are known from South Africa: *hirtibasis* (Bigot, 1885), *natalensis* Zielke, 1970, *patersoni* Zielke, 1970, *perplexa* Emden, 1951, *setulosa* Zielke, 1970, and *stuckenbergi* Zielke, 1970. The new species differs from all of these in the male sex by the spine-like

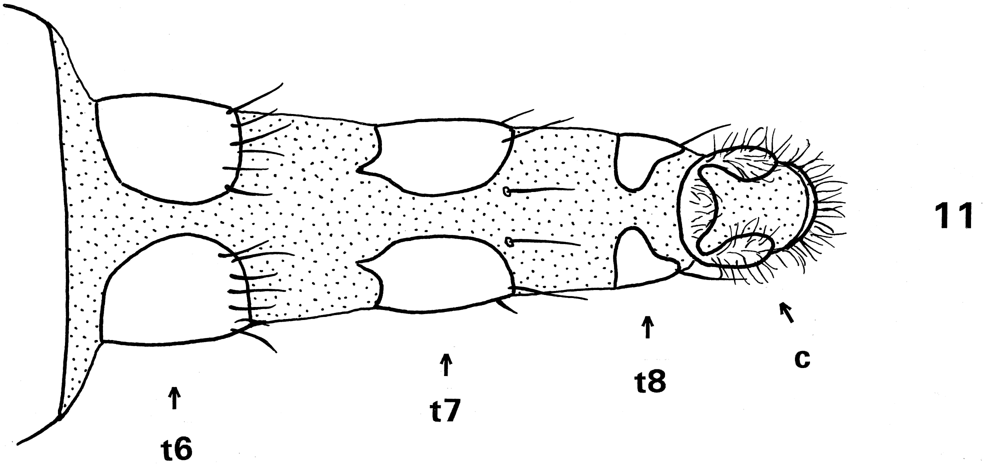


Fig. 11. *Xenomyia osculata* sp. n. ♀ (paratype). Ovipositor, dorsal view. t - tergite; c -cercus.

posteroventral setae on the fore femur (Fig. 4), the dark cloud of microtrichiae on the wing (Fig. 5), and the absence of ocellar setae. The following brief key will enable the South African species to be separated:

Key to *Xenomyia* species of Southern Africa

1. Ocellar setae absent (Figs 1–2). Proboscis slender, elongate (Fig. 3). Katepisternal setae 1+2. Mid femur without trace of ventral setae. Presutural intra-alar seta (inner posthumeral) present. ♂: fronto-orbital plates enlarged, completely suppressing frontal vitta, and covered with short dense setulae (Figs 1, 3). ♀ : 1–2 pairs of orbital setae, directed inwards and forwards (Fig. 2) 2

– Ocellar setae present and well-developed. Proboscis short, stout, bulbous. Katepisternal setae 1+1 or 0+1. Mid femur with at least short posteroventral setae (rarely absent in ♀). Presutural intra-alar seta (inner posthumeral) absent. ♂: frons of normal structure, with frontal vitta well-developed and much broader than a fronto-orbital plate. ♀ : 1 pair of reclinate orbital setae 3

2 (1) 1 postpronotal seta, the entire lobe covered with short dense setulae. Hind femur without anteroventral setae. Lower calypter creamy. ♂: wing with a dark cloud formed by dense, elongated microtrichiae (Fig. 5) .... **osculata** sp.n.

– 2 postpronotal setae, the lobe with the usual fine sparse setulae. Hind femur with 1 anteroventral seta. Lower calypter dirty yellow. ♂: wing clear .... **patersoni** Zielke

3 (1) Katepisternal setae 1+1. 2 pairs of presutural dorsocentral setae, though anterior pair may be short 4

– Katepisternal setae 0+1. Only 1 pair of presutural dorsocentral setae 5

4 (3) Lower calypter yellow. Only 1 postpronotal seta. Fore tibia without posteroventral setae .... **hirtibasis** (Bigot)

– Lower calypter brown. 1 strong and 1 weak postpronotal setae. Fore tibia with 1–2 posteroventral setae .... **stuckenbergi** Zielke

5 (3) Anal vein (vein A_1) of normal length, reaching more than halfway from its base to wing-margin. Claws moderately elongate, equal to length of tarsomere 5 on all legs. Hind tibia with 1 anteroventral seta. ♀ : mid femur with 1–2 posteroventral setae in basal half; hind femur with 1 posteroventral seta in basal half .... **setulosa** Zielke

– Anal vein (vein A_1) very short, not reaching halfway from its base to wing-margin. Claws very elongate, on fore leg equal to length of tarsomeres 4+5 combined. Hind tibia without anteroventral setae, except for *perplexa* ♂ which has a row of such setae. ♀ : mid and hind femora without posteroventral or anteroventral setae 6

6 (5) ♂: hind tibia without anteroventral setae; fore tibia without a posteroventral seta; hind femur with rows of anteroventral and posteroventral setae .... **natalensis** Zielke

– ♂: hind tibia with a row of long anteroventral setae; fore tibia with a posteroventral seta; hind femur with a few posteroventral setae before tip, without anteroventrals .... **perplexa** Emden

Within the broader afrotropical context, there are five species with the unique ♂ head structure shown in Figs 1–3: *azurescens* Emden, 1951 (Uganda), *calyptrata* Emden, 1951 (Kenya, Uganda), *edwardsi* Emden, 1951 (Kenya, Tanzania, Uganda), *oxycera* Emden, 1951 (Ivory Coast, Nigeria, Uganda), and *patersoni* Zielke, 1970 (South Africa). *X. osculata* will key to *azurescens* in Emden's (1951) key, but differs most obviously by the yellow, brown-tipped palpi and the single postpronotal seta. *X. patersoni*, the only other South African species of this group, differs by having strong ocellar setae, dark brown palpi, 2 postpronotal setae, ♂ hind femur with an anteroventral seta, and ♂ wing clear.

Discussion: According to R. W. Palmer (*pers. comm.*), this species was found in high numbers at Gifkloof in spring. It probably feeds both as an adult and as a larva mainly on *Simulium chutteri* Lewis, which is by far the most abundant blackfly in the middle and lower Orange River. During the six years of weekly monitoring (1991–1996), larval *Xenomyia* were most abundant in spring and early summer (October–December) and favoured the algal mats (*Cladophora glomerata*, sometimes *Stigeoclonium* or *Spyrogyra*) that grew on stones in the current, particularly in areas where the current was moderate to slow. In 1996, high numbers of larval *Simulium* in October were followed by particularly high numbers of *Xenomyia* in November. Analysis of river conditions and invertebrate population dynamics showed that populations of larval *Xenomyia* increased significantly when flow conditions had been stable for at least 30 days. Other members of this benthic community included the chironomid *Cardiocladius africanus* Freeman, 1955, the larvae of which are also known to prey on the aquatic stages of blackflies (Werner & Pont, 2003).

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REFERENCES

CROSSKEY, R. W. & DAVIES, J. B. 1962. *Xenomyia oxycera* Emden, a muscid predator on *Simulium damnosum* Theobald in Northern Nigeria. *Proceedings of the Royal Entomological Society of London* (A) **37**: 22–26.

ELSEN, P. 1977. Note biologique sur *Xenomyia oxycera* Emden (Muscidae Limnophorinae) et *Ochtera insularis* Becker (Ephydridae), deux diptères prédateurs de *Simulium damnosum* Theobald (Diptera Simuliidae) en Côte d'Ivoire. *Revue Zoologique Africaine* **91**: 732–736.

EMDEN, F. I. VAN. 1951. Muscidae: C. - Scatophaginae, Anthomyiinae, Lispinae, Fanniinae and Phaoniinae. *Ruwenzori Expedition 1934–35*. London: British Museum (Natural History) **2**: 325–710.

GOUTEUX, J. -P. 1977. Observations morphologiques et écologiques sur les stades préimaginaux de *Xenomyia oxycera* Emden, 1951 (Muscidae Limnophorinae), diptère prédateur de *Simulium damnosum* s.l. (Diptera Simuliidae). *Revue Zoologique Africaine* **91**: 618–622.

MCALPINE, J. F. 1981. Morphology and terminology - Adults. *In*: McAlpine, J. F. *et al.*, eds, *Manual of Nearctic Diptera*. Vol. 1. Research Branch, Agriculture Canada, Monograph **27**: 9–63.

PALMER, R. W. 1997. Principles of integrated control of blackflies (Diptera: Simuliidae) in South Africa. Report to the Water Research Commission by Onderstepoort Veterinary Institute. Water Research Commission Report 650/1/97: xxv + 307 pp.

PALMER, R. W., EDWARDES, M. & NEVILLE, E. M. 1996. Control of pest blackflies (Diptera: Simuliidae) along the Orange River, South Africa: 1990–1995. *Onderstepoort Journal of Veterinary Research* **63**: 289–304.

PONT, A. C. 1980. Family Muscidae. *In*: Crosskey, R. W., ed., *Catalogue of the Diptera of the Afrotropical Region.* London: British Museum (Natural History) pp. 721–761.

WERNER, D. & PONT, A. C. 2003. Dipteran predators of simuliid blackflies: a worldwide review. *Medical and Veterinary Entomology* **17**: 115-132.